

CLAIMS

What is claimed is:

1. A filter element for mounting in a filter housing, said filter element comprising filter media, and a support frame supporting said filter media, said support frame having a seal integrally formed therewith for sealing against said filter housing.
2. The filter element according to claim 1 wherein said seal is integrally molded with said support frame.
3. The filter element according to claim 1 wherein said seal is softer than said support frame.
4. The filter element according to claim 3 wherein said support frame is substantially rigid.
5. The filter element according to claim 1 wherein said support frame and said seal are of different materials.
6. The filter element according to claim 5 wherein the material of said seal is softer than the material of said support frame.
7. The filter element according to claim 6 wherein each of said materials is heat and chemical resistant, including the softer material of said seal.
8. The filter element according to claim 1 wherein in combination: said support frame is an injection molded plastic member; and said seal is an injection molded thermoplastic member,

neither said support nor said seal being potted.

9. The filter element according to claim 1 wherein said seal is TPE.

10. The filter element according to claim 1 wherein said seal is TPV.

11. The filter element according to claim 1 wherein said seal is TPSiV.

12. The filter element according to claim 3 wherein:

said filter element is an annular filter element extending axially along an axis between first and second axial ends, and having a hollow interior;

said support frame is an end cap at one of said axial ends, said end cap
5 having an aperture therethrough communicating with said hollow interior;

said seal is integrally formed on said end cap for sealing against said filter housing.

13. The filter element according to claim 12 wherein:

said end cap has an axially facing first annular surface circumscribing said aperture, and a radially facing second annular surface circumscribing said aperture;

5 said seal extends along at least one of said first and second annular surfaces and engages a portion of said filter housing facing said one annular surface, with said seal spanning between said one annular surface and said portion of said filter housing.

14. The filter element according to claim 13 wherein said seal extends along both of said first and second annular surfaces of said end cap and

comprises a first segment engaging a first portion of said filter housing axially facing said first annular surface of said end cap, and a second segment engaging a second portion of said filter housing radially facing said second annular surface of said end cap.

15. The filter element according to claim 14 wherein both of said first and second segments have one or more deflection fingers extending therefrom and deflectingly engaging a respective said portion of said filter housing, at least one of said fingers being axially deflected, and at least another of said fingers being radially deflected, each said deflection finger forming an annular seal with said filter housing.

16. The filter element according to claim 13 wherein said seal extends along said first annular surface of said end cap and has a V-shape with the apex of the V at said axially facing first annular surface of said end cap, and the legs of the V diverging from said apex and engaging said filter housing at radially spaced engagement points each defining an annulus circumscribing said aperture.

17. The filter element according to claim 13 wherein said seal extends along said radially facing second annular surface of said end cap and has a plurality of angled barbs extending radially and axially from said second annular surface and engaging said filter housing at axially spaced engagement points each defining an annulus circumscribing said aperture.

18. The filter element according to claim 13 wherein:
said seal extends along said axially facing first annular surface of said end cap and has a V-shape with the apex of the V at said axially facing first annular surface of said end cap, and the legs of the V diverging from said apex and engaging said filter housing at a first set of engagement points radially spaced from each other

and defining a first set of annuli circumscribing said aperture;

10 said seal extends along said radially facing second annular surface of said end cap and has a plurality of angled barbs extending radially and axially from said radially facing second annular surface and engaging said filter housing at a second set of engagement points axially spaced from each other and defining a second set of annuli circumscribing said aperture.

19. The filter element according to claim 12 wherein said end cap has an axially facing annular surface circumscribing said aperture, and said seal is on said axially facing annular surface of said end cap.

20. The filter element according to claim 19 wherein said seal has a flat first surface on said axially facing annular surface of said end cap, and has an arcuate second surface engaging said filter housing in sealing relation along an annulus circumscribing said aperture.

21. The filter element according to claim 20 wherein said seal is semi-circular in radial cross-section.

22. The filter element according to claim 12 wherein said end cap has an axially facing annular surface circumscribing said aperture, and a pair of walls extending axially from said surface and separated by a radial gap therebetween, said gap defining an annular channel circumscribing said aperture, and wherein said seal is
5 in said annular channel.

23. The filter element according to claim 12 wherein:
 said end cap has an axially facing first annular surface circumscribing said aperture, and a radially facing second annular surface circumscribing said aperture;

5 said seal extends along both of said annular surfaces of said end cap and comprises a first segment engaging a first portion of said filter housing axially facing said first annular surface of said end cap, and a second segment engaging a second portion of said filter housing radially facing said second annular surface of said end cap;

10 said first segment of said seal extends axially beyond said first annular surface of said end cap and is tapered radially outwardly from said aperture away from said second segment of said seal.

24. The filter element according to claim 12 wherein said end cap has a radially facing annular surface circumscribing said aperture, and said seal is on said radially facing annular surface and circumscribes said aperture.

25. The filter element according to claim 24 wherein said seal has a first arcuate surface on said radially facing annular surface of said end cap, and has a second arcuate surface engaging said filter housing along an annulus.

26. The filter element according to claim 25 wherein said radially facing annular surface of said end cap is a recessed annular groove receiving said first arcuate surface of said seal therein.

27. The filter element according to claim 25 wherein said radially facing annular surface of said end cap is a protruding lip receiving said first arcuate surface of said seal thereon.

28. The filter element according to claim 27 wherein said seal has a C-shaped with first and second generally parallel C-shaped surfaces, said first C-shaped surface being said first arcuate surface of said seal, said second C-shaped surface being said second arcuate surface of said seal, said first and second arcuate

5 surfaces of said seal being generally parallel to each other.

29. The filter element according to claim 24 wherein said radially facing annular surface of said end cap faces radially inwardly.

30. The filter element according to claim 24 wherein said radially facing annular surface of said end cap faces radially outwardly.

31. The filter element according to claim 30 wherein said seal extends radially outwardly from said radially outwardly facing annular surface of said end cap.

32. The filter element according to claim 3:
said filter element is a panel filter element lying in a plane and having a perimeter;

5 said support frame extends along said plane around said perimeter of said panel filter element, said plane defining a lateral dimension, said support frame having a sidewall extending longitudinally along a height dimension transverse to said plane and said lateral dimension;

said seal is integrally formed on said sidewall of said support frame for sealing against filter housing.

33. The filter element according to claim 32 wherein said seal extends laterally from said sidewall.

34. The filter element according to claim 33 wherein said seal has an eccentric shape in lateral cross-section.

35. The filter element according to claim 32 wherein said seal

extends longitudinally from said sidewall.

36. The filter element according to claim 35 wherein said sidewall extends longitudinally between first and second distally spaced ends, and said seal comprises a first seal on said first end and a second seal on said second end.

37. The filter element according to claim 32 wherein said sidewall has a first longitudinally facing surface and a second laterally facing surface, and wherein said seal extends along both of said first and second surfaces of said sidewall.

38. The filter element according to claim 37 wherein said seal extending along said second surface of said sidewall has a chevron shape.

39. The filter element according to claim 32 wherein said sidewall has a first longitudinally facing surface, a second laterally facing surface, and a third longitudinally facing surface, said first and third surfaces being distally longitudinally spaced by said second surface therebetween, and wherein said seal extends along all
5 three of said first, second and third surfaces.

40. The filter element according to claim 39 wherein said seal extends along the entire longitudinal dimension of said sidewall and has a first portion extending longitudinally from said first surface of said sidewall, a second portion extending laterally from said second surface of said sidewall, and a third portion
5 extending longitudinally from said third surface of said sidewall.

41. The filter element according to claim 33 wherein said seal has a pair of deflection fingers longitudinally spaced from each other and laterally deflectable for sealing against said filter housing.

42. The filter element according to claim 41 wherein said fingers diverge from each other in a V-shape from an apex at said sidewall, each finger extending obliquely relative to each of said longitudinal and lateral directions.

43. A method for making a filter element for mounting in a filter housing, said filter element comprising filter media, and a support frame supporting said filter media, said method comprising injection molding said support frame, and injection molding a seal onto said injection molded support frame to seal against said
5 filter housing.

44. The method according to claim 43 comprising injection molding said support frame in a first mold, then removing said support frame from said first mold and placing said support frame in a second mold, then injection molding said seal onto to said support frame in said second mold.

45. The method according to claim 43 comprising injection molding said support frame in a mold, then injection molding said seal onto said support frame in the same said mold.